Antiferromagnetism and high-T_c superconductivity in cuprates and Fe-pnictides

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In the first part, we review extensive studies on multilayered copper oxides by means of site-selective NMR, which have uncovered the intrinsic phase diagram of antiferromagnetism(AFM) and high-Tc superconductivity(HTSC) for a emergence disorder-free CuO_2 plane with hole carriers. We present the existence of AFM metallic state, the uniformly mixed phase of AFM and HTSC, and the *d*-wave SC with a maximum of T_c just outside a critical carrier density, at which the AFM moment disappears. These results can be accounted for by the *Mott physics* based on the *t*-*J* model. The large superexchange interaction $J_{\rm in}$ plays the vital role as the glue for the Cooper pairs, which is the main reason for raising the T_c in cuprates.[1] In second topics, we present ^{75}As-nuclear quadrupole resonance (NQR) studies on $(Ca_4Al_2O_{6-y})(Fe_2As_2)$ with $T_{\rm c} = 27$ K. Measurement of $1/T_1$ has revealed a significant development of AFM spin fluctuations down to T_c. Below $T_{\rm c}$, the temperature dependence of $1/T_1$ without any trace of the coherence peak is well accounted for by an $s_{\pm}$-wave multiple gaps model. From the fact that $T_{\rm c}$ is comparable to T_c=28 K in the optimally-doped $LaFeAsO_{1-y}$ in which AFM spin fluctuations are not dominant, we remark that AFM spin fluctuations are not a unique factor to enhance T_c among existing Fe-based superconductors, but a condition for optimizing SC should be addressed from the lattice structure point of view. [2]

[1] H. Mukuda et al, Special topics in J. Phys. Soc. Jpn (2012)

[2] H.Kinouchi et al., Phys. Rev. Lett, in press.